Management Plan

Inelastic X-ray Scattering CAT

September 2002

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1 Introduction

The inelastic x-ray scattering collaborative access team (IXS-CAT) has been formed to create and run a beamline dedicated to the study of excitations in systems using inelastic x-ray scattering. This sets it apart from other CATs organized by region or designed to use a variety of techniques to study a particular set of problems. By their very nature, inelastic x-ray scattering experiments require highly complex setups, and this requirement makes time sharing with other experiments extremely inefficient. The CAT will have two main instruments: a high-resolution instrument for studying meV excitations, and a medium-resolution instrument for studying excitations with energies on the order of a few hundred meV.

The IXS-CAT members come both from the existing inelastic x-ray scattering community and from the broader scientific community that would like to have access to such an instrument but lack the expertise or resources to operate one. They share the common belief that inelastic x-ray scattering can address some of the important problems in their fields. The strength of IXS-CAT lies in this extremely broad scientific program ranging from condensed-matter physics, to polymer science to biology, together with the resources that the CAT members bring to the consortium.

The member institutions of the CAT are listed below;
Albert Einstein College of Medicine
Argonne National Laboratory
Brookhaven National Laboratory
Carnegie Institute of Washington
Lucent Technologies
Massachusetts Institute of Technology
Northeastern University
Oak Ridge National Laboratory
State University of New York, Stony Brook
University of Akron
University of California, San Diego
University of Illinois at Chicago
University of Illinois at Urbana-Champaign
University of Tennessee
University Pennsylvania
Western Michigan University

The management structure for the CAT is based on the dispersed membership and is given in section 2. The construction plan is given in overall form in section 3, with a detailed work breakdown structure (WBS) provided as appendix A. While this plan may change somewhat over time, we expect it to be fairly accurate. The implementation of this plan in terms of quality assurance/control, procurement, cost control, and funding are described in the next four sections (4-7).

Safety is of key concern in the construction and running of the CAT and the overall plan is described in section 8. A more detailed safety plan will be developed based on the principles described there.

Due to the extended nature of the CAT member institutions, the dissemination of information between the CAT members is of key importance and is described in section 9.

Finally, we have detailed our operation plan, including our independent investigator program, in the final sections of the plan (10-11).

2 IXS-CAT Organization

The IXS-CAT organizational chart is shown in Figure 1 below. The basic structure will be used for both the construction and the operations phases although there are some differences (described below) due to the different concerns during the different phases. The current list of personnel for the various positions is also shown in figure 1.

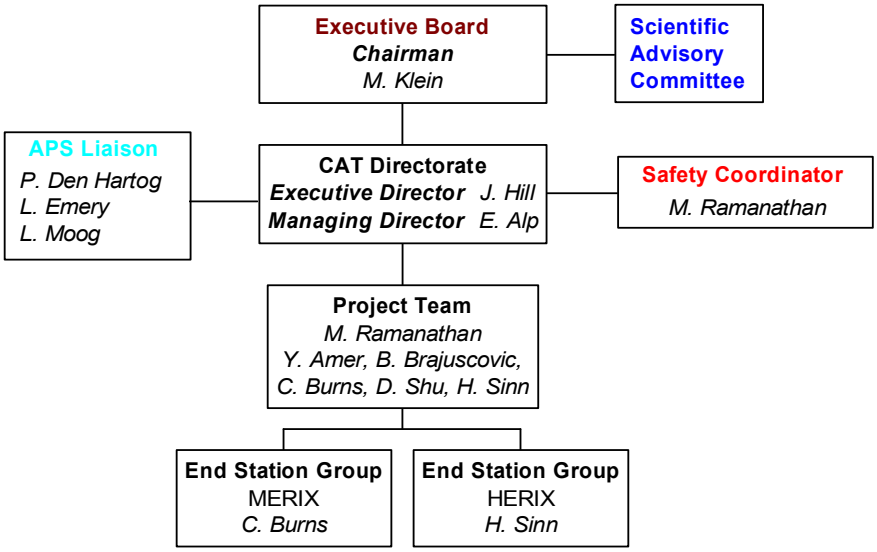

Figure 1. Organization Chart

The IXS-CAT is managed by an Executive Board (EB), which is elected by the members of the CAT. It consists of nine regular members: seven from the institutions providing substantial support to the CAT, and two members elected from the CAT membership. The Executive and Managing Directors, if not already members of the board, will be ex-officio members. The institutions having a member on the board are given below (the initial member from that institution is given in parenthesis).

Advanced Photon Source, Argonne National Laboratory (Efim Gluskin)
Bell Laboratories, Lucent Technologies (Eric Isaacs)
Brookhaven National Laboratory (C.C. Kao)
State University of New York at Stony Brook (Peter Stephens)
University of Illinois at Urbana-Champaign (Miles Klein)
University of Pennsylvania (Takeshi Egami)
Western Michigan University (Clement Burns)

The two initial at large members are:
University of California, San Diego (Sunil Sinha)
Advanced Photon Source, Argonne National Laboratory (Harald Sinn)

Changes in the membership of the EB are possible after the end of a full term. Removal of an institution from the EB requires a 2/3 vote of approval from the EB members and then a majority vote from the CAT membership. Institutions that later bring substantial resources to the CAT can also be added to the board, with the same voting requirements as for removal of a member. Where appropriate, beamline staff will sit in on board meetings as nonvoting members.

Elected EB members will serve for a four-year term. During the planning and construction phases, the initial make-up of the board will persist, but if there are resignations, new members shall be elected by the CAT membership. Elections will be carried out electronically and nominations will be accepted from all CAT members.

Conflicts of interest can arise for members of the EB. In such an event, the member with the conflict of interest will be expected to recuse themselves from the discussion and the vote on that issue.

In the event that a scientific member of the EB changes institutions, the roles of the new and old institutions are expected to be negotiated between these two institutions and must then be approved by the IXS-CAT EB.

The EB will elect a chair, who is responsible for arranging meetings of the board, distributing agendas, relevant information, minutes, etc.

The board has a number of responsibilities, which include

- Establishing and developing the scientific mission of IXS-CAT
- Appointing and defining the roles of the CAT Executive Director and Managing Director
- Adding/removing members and institutions from IXS-CAT
- Overseeing and assessing the scientific and technical efforts, as well as the administration, of IXS-CAT
- Ensuring that productive use is made of allocated beam time
- Coordinating and overseeing funding issues
- Approving large fund expenditures (defined below)

- Approving overall design of the beamline/end station and its technical components, including major changes or alterations
- Assuring that the construction and operation of the beamline avoids safety and environmental hazards
- Assuring compliance with APS policies for users
- Overseeing and monitoring reporting activities between the CAT and the CAT membership, the APS, the funding agencies, and the scientific community at large
- Developing and approving beamline allocation formulas and approving changes to these formulas.

The Executive Board is expected to meet least twice a year. Time-sensitive issues that need to be handled between meetings may be taken care of by phone conferences and email votes as needed. Summaries of all business that takes place via conference calls and e-mail will be written up and submitted as minutes at a regular meeting.

The IXS-CAT Director Team

The CAT Executive Director (ED) and Managing Director (MD) are appointed by the EB, generally for a period of three years. They will be authorized by the Board to carry out many of the Board's responsibilities. The present Executive Director is John Hill of Brookhaven National Laboratory. The present Managing Director is E. Ercan Alp of Argonne National Laboratory. Whereas they are expected to work together on most matters, specific duties will be assigned to each. The Executive Director will have the authority for fund raising, management of the budget, representing the CAT before external groups, and overall responsibility for the CAT to the Board. The Managing Director will have authority for beam line construction and eventual operation. He will represent the CAT before internal APS bodies. The MD will be authorized to insure that all IXS-CAT activities are conducted safely, in conformance with APS safety procedures. The ED and MD will make regular progress reports to the EB.

The ED and MD will be authorized by the EB to undertake the following:

- Submit to the EB, construction and staffing plans consistent with the goals and funding of IXS-CAT
- Hire beamline personnel (with concurrence of the EB)
- Ensure that the beam time is used productively
- Implement operation modes and schedule beam time allotment for CAT members and users consistent with IXS-CAT and APS policies.

Executive Director

- See that the beamline carries out the scientific vision of the EB
- Oversee financial aspects of the CAT, including development of adequate funding
- Present an annual budget to the EB
- Oversee the budget, working with the PIs of the DOE and NSF construction grants, coordinating the funding efforts between IXS-CAT and the different

institutions involved, handling reporting requirements, and interacting closely with Grants, Contracts, and purchasing offices at the universities and the APS
- Represent IXS-CAT to external bodies, including funding agencies, review committees, and the Scientific Advisory Committee of the APS. In addition, may attend research directors meetings.

Managing Director

- Oversee the project team in matters of design, specification, procurement, fabrication, installation, and commissioning of the beamlines and experimental facilities
- Manage beamline personnel.
- Ensure that the beamlines are designed, built and operated so that they are not a hazard to people or the environment
- Assure that beamline schedule and cost objectives are achieved
- To represent IXS-CAT within the APS, including the research directors meetings, providing the APS with required documents, following policies related to users, and carrying out other required tasks.

Scientific Advisory Committee

An outside review committee has been formed to review the technical aspects of the beamline design and construction. After the beamline is commissioned, this committee (with appropriate changes in membership) will be asked for advice about the scientific program of IXS-CAT.

Project Team

The project team will construct the beamline. It will be led by the project manger, presently M. Ramanathan of the APS. He will be responsible for the procurement and construction of the experimental stations according to the plans approved by the EB. Other team members will have specific responsibilities for the design and construction of the monochromators, experimental stations, and spectrometers. For proper coordination, the end station Principal Scientists (described below) will be members of the project team.

Safety Coordinator

The safety coordinator has the responsibility for insuring that all CAT construction activities are carried out in accordance with the IXS-CAT Safety Plan, with APS and ANL-E health and safety requirements, and any other applicable state and federal statutes. The safety coordinator shall have the responsibility and authority to stop any action or experiment deemed unsafe without requiring approval of the Executive or Managing Directors (or anyone else). The current safety coordinator is M. Ramanathan.

End Station Groups and Principal Scientists

The high- and medium-resolution spectrometers, HERIX and MERIX, will be the respective responsibility of two principal scientists, presently H. Sinn and C. Burns. They will integrate the beamline layout to the needs of their instruments and, in so doing, will work closely with the project team. They are expected to originate purchase orders regarding the experimental station instrumentation, motion control, and data acquisition. They will also have primary responsibility for building up their respective end station groups, including the students, post-doctoral research associates, and junior scientists.

APS Liaisons

The IXS-CAT members have a number of innovative ideas. Their implementation will depend critically on the coordination of various APS divisions, specifically the Accelerator Systems, Accelerator Operations and Experimental Facilities Divisions. Representatives from these units will serve as contact personnel, will be on the internal mailing list of the IXS-CAT, and will be invited to relevant planning and information sessions.

3 Work Breakdown Structure

A work breakdown structure (WBS) for IXS-CAT has been established, broken down to the level at which cost, schedule and effort levels can be estimated. Modifications to the WBS may be necessary, depending especially on the funding situation. The WBS is shown in appendix A. Each aspect of the WBS will be the responsibility of a given individual. Effort costs have not been included as these will be provided by the APS and some of the member institutions.

4 Quality Assurance and Control.

The IXS-CAT construction and operation will be conducted within the framework of an effective quality assurance and control (QA/QC) program. Special attention will be given to items that will affect beamline safety, reliability, and the quality of the research. The QA/QC efforts will be commensurate with the importance and complexity of the equipment and operations. External vendors/contractors will be selected that have established satisfactory QA/QC procedures.

The responsibility for quality will reside with the person in charge of the specific WBS task. The overall oversight of QA/QC matters falls under the authority of the Managing Director.

The following steps will be taken during the construction phase to guarantee quality assurance:

- A formal technical review of the beamline design will be conducted to assess the design with respect to the mission of IXS-CAT.
- Line responsibilities and authorities for QA/QC will be documented and disseminated.
- Whenever possible, industrial and national standards for design will be used. Previously used designs, software, etc. will be used when possible, and when these earlier designs have been tested and shown to be effective.
- Changes to design and specification documents will require written approval by the Managing Director, and substantial changes will be submitted to the Executive and Managing Directors and to the APS for review and approval. Changes will be signed and dated and put on file in a controlled storage file.
- All final design documentation, specifications, software, and procurement documents will be controlled documents, filed in a controlled storage area. All received equipment for a given part of the WBS will be inspected by the person in charge of that aspect of the WBS to assure it meets the specifications.
- The responsibility for the environmental and safety protection standards is given to the person in charge of QA/QC for a given item. They will consult with the CAT Safety Coordinator and with APS safety personnel as needed.

5 Procurement, Fabrication, and Cost Control

The IXS-CAT will use the procurement facilities of State University of New York at Stony Brook (SUNY-SB) and Western Michigan University (WMU) (each for the individual grants) to obtain equipment. The institutions will each designate a procurement expert to expedite matters for this project. Accounts will be established at the APS to provide access to the shops and storehouse. WMU will also provide VISA cards to personnel designated by the MD for low-value supply purchases. Monthly statements will be sent to the ED and other responsible members.

Advanced procurement plans will be developed for long-lead-time items. Whenever possible, and especially for major items, suppliers with a known successful track record in supplying equipment to the APS will be used. Construction in many cases will be contracted out through the APS.

General limits on costs are given below. Changes to these rules will require a vote of the EB. These limits hold for all expenditures.

- Purchases under $5000 (up to a pre-determined budgetary limit) are handled by WBS component designers and do not need director approval.
- Purchases from $5000-$100,000 require the approval by the Managing and Executive Directors.
- Purchases above $100,000 require approval of the EB.

In all of these cases, the amount will be entered in a local funding database in order to allow accurate tracking of the total expenditures for the project. The QA/QC procedures

as described earlier will be followed for all purchases, with the level of scrutiny increasing as the value of the purchase increases.

Components that must be fabricated will usually be made using the APS/ANL shops, although, in some cases where it is cheaper and advantageous to do so, items may be made at one of the member institutions, or elsewhere.

6 Funding

The funding for IXS-CAT will come from DOE, NSF, APS, and the member institutions. In particular, the NSF will provide $900,000 over three years, member institutions have pledged another $550,000, and the DOE will provide $5,000,000 over the course of five years. Additional money or in-kind contributions are likely from several institutions that did not contribute to the first phase. The APS is committed to providing the insertion device chamber, insertion devices and the front end. In addition, the APS has committed personnel for project management.

The final control of the beamline funding is under the direction of the CAT Executive Director. The funding from the NSF grant is designated for the high resolution inelastic x-ray scattering instrument (HERIX), and these funds will flow through SUNY-SB. Funding for the medium resolution spectrometer (MERIX) and many of the common components is by the DOE through WMU. The Executive Director is responsible for coordinating the funding from these two sources (and others).

7 Cost, Schedule, and Performance Control

The general construction plan is shown in the WBS as described in appendix A. The cost and schedules for construction are based on this structure and are shown in the same appendix. The Executive Director is ultimately responsible for monitoring and reporting the adherence of the construction to the plan provided. Updates will be made in the projected budget figures as the project moves forward and more detailed information in the forms of bids and actual expenditures are available.

Substantial changes or alterations that will significantly affect the project progress or cost and possibly the mission of the CAT will be brought to the notice of the EB for approval.

Official cost accounting will be carried out by the institutions that are officially responsible for the budgets. However, a common cost accounting systems that keeps track of the items and the different budgets will be implemented to allow for more timely information.

8 Safety Requirements

Health and safety considerations are vitally important during the design, construction, and operation of IXS-CAT. The IXS-CAT intends to fully comply with all health and safety regulations and requirements of Argonne National Laboratory (ANL) and the APS. The Safety Coordinator (SC) for the beamline will have responsibility for the safety measures; the Managing Director has line management responsibility for safety.

The responsibilities of the SC include the development of a construction safety plan that meets APS approval prior to the beginning of construction. The SC will ensure that personnel, outside users, and contractors meet required health and safety requirements. In addition, the SC will make sure that the safety plan is being properly followed. The coordinator has the responsibility and the authority to stop any and all work that is not being carried out according to the requirements or is found to be unsafe in any fashion.

Before the operational phase, the SC will be responsible for developing an IXS-CAT specific Safety Plan and Safety Manual. This plan will be approved by APS prior to operations. Based on this plan, a training program will be required of all staff and outside users prior to using the beamline. All staff and users will comply with APS and ANL safety requirements. All use of potentially hazardous chemical or biological or radiological materials for experiments will require prior approval by the SO, as well as a written plan describing their use during the experiment and their disposal after the experiment is over.

The SC (and other staff as relevant) will work closely with the APS personnel during the construction phase to insure compliance with safety regulations. The IXS-CAT will use APS-designated safety interlock systems that will be installed by APS staff. A number of CAT members are presently working at the APS and are very familiar with safety procedures there.

9 Reporting and Information

The IXS-CAT is a technique-based CAT rather than one based around a relatively small number of institutions. It therefore has a wide variety of members from a large number of different institutions. Communication between the different members is therefore even more important than at many other CATs. Adequate communication between the different CAT members, the Executive Board, the APS, and the funding agencies is essential to the construction and successful operation of the CAT. In order to insure adequate communication, the following steps will be taken.

- The EB for the CAT will hold two regular meetings yearly to discuss construction/operational issues. Due to the wide geographical spread in the membership, these meetings will need to be supplemented by phone and videoconferencing.

- Results of the meetings will typically be sent by email to CAT members. A web site that contains a record of the meeting results will also be implemented. Other documentation and information (Safety plan, Reports of Beamline Design Reviews and Inspections, etc.) will also be posted to the WEB site.
- Project management reports, including construction overviews, yearly financial report, and equipment inventory will be provided to the EB.
- The Scientific Advisory board of the APS will also hold regular meetings to evaluate the construction and scientific program of the CAT.
- Regular reports on the beamline construction progress will be submitted to the APS by the Managing Director, describing the progress as compared to the milestones established. All publications, patents, etc., will be submitted to the APS in a timely manner.
- A Preliminary Design Report will be produced within a few months of the official start of the CAT that will include the overall beamline design plan and the construction schedule.
- Any changes in the design/scope of the project, or in the funding, or in the CAT membership will be reported to the EB and the APS.
- Independent investigators (II) will be informed about the availability of time as well as the technical capabilities of the beamline. A report to the APS on the II program will be submitted annually to the APS.

10 Operation Plan

A detailed Operational Plan that is consistent with the operational funding will be developed at a later date in consultation with the APS.

11 General User Program

A plan for the GU program will be developed later in consultation with the APS.

Appendix A Work Breakdown Structure for IXS CAT

IXS WBS and Schedule

WBS	Activity Name	Start Date	Finish Date	Responsibility	BUDGET K$	DOE 02 K$	NSF 02 K$	DOE 03 K$	NSF 03 K$	MF 03 K$	DOE 04 K$	NSF 04 K$	MF 04 K$	DOE 05 K$	DOE 06 K$
1.1	**Project Planning**		9/29/06	**E. Alp**	**0.0**										
1.1.1	CDR		9/6/02		**0.0**										
1.1.2	Management Plan		9/20/02		**0.0**										
1.1.3	Safety Plan		9/20/02		**0.0**										
1.1.4	Cost & Schedule Plan		9/20/02		**0.0**										
1.1.5	MOU		10/21/02		**0.0**										
1.1.6	PDR		1/10/03		**0.0**										
1.1.7	FDR		6/4/04		**0.0**										
1.1.8	Commissioning														
1.1.8.1	Shielding Verification Station A		10/15/04		**0.0**										
1.1.8.2	Commissioning Station A Optics	10/18/04	1/28/05		**0.0**										
1.1.8.3	Shielding Verification Station B		2/4/05		**0.0**										
1.1.8.4	Shielding Verification Station C		2/4/05		**0.0**										
1.1.8.5	Commissioning Station B	2/7/05	9/29/06		**0.0**										
1.1.8.6	Commissioning Station C	2/7/05	9/29/06		**0.0**										
1.2	**SR Modifications**		9/24/04	**L. Emery**	**0.0**										
1.3	**Straight Section Vacuum Chamber**		9/24/04	**P. Den Hartog**	**0.0**										
1.4	**Insertion Devices**		9/24/04	**L. Moog**	**0.0**										
1.5	**Front End**		9/24/04	**P. Den Hartog**	**0.0**										
1.6	**Beamline Stations & Infrastructure**		9/3/04	**M. Ramanathan**	**0.0**										
1.6.1	Station A														
1.6.1.1	Design	9/16/02	12/20/02		**0.0**										
1.6.1.2	Procurement	1/6/03	3/3/03		**198.0**	198.0									
1.6.1.3	Installation	7/7/03	10/3/03		**0.0**										
1.6.2	Station B														
1.6.2.1	Design	9/16/02	12/20/02		**0.0**										
1.6.2.2	Procurement	1/6/03	3/3/03		**396.0**	396.0									
1.6.2.3	Installation	7/7/03	10/3/03		**0.0**										
1.6.3	Station C														
1.6.3.1	Design	9/16/02	12/20/02		**0.0**										
1.6.3.2	Procurement	1/6/03	3/3/03		**770.0**	406.0		364.0							
1.6.3.3	Installation	7/7/03	10/3/03		**0.0**										
1.6.4	Beamline Utilities														
1.6.4.1	Design	11/18/02	3/21/03		**0.0**										
1.6.4.2	Procurement	3/1/04	4/30/04		**150.0**						150.0				
1.6.4.3	Installation	6/1/04	9/3/04		**0.0**										
1.6.5	Work Area Enclosure														
1.6.5.1	Enclosure														
1.6.5.1.1	Design	11/18/02	3/21/03		**0.0**										
1.6.5.1.2	Procurement	3/24/03	8/29/03		**140.0**					140.0					
1.6.5.1.3	Installation	10/13/03	1/15/04		**0.0**										
1.6.5.2	Furniture	6/1/04	9/3/04		**50.0**						50.0				
1.6.5.3	Computers	6/1/04	9/3/04		**20.0**						20.0				
1.6.5.4	Printers	6/1/04	9/3/04		**10.0**						10.0				
1.6.5.5	TV Monitors	6/1/04	9/3/04		**5.0**						5.0				
1.7	**Beamline Optics**		3/4/05	**M. Ramanathan**	**0.0**										
1.7.1	White Beam Slits														
1.7.1.1	Design	5/5/03	8/8/03		**0.0**										
1.7.1.2	Procurement	8/11/03	10/3/03		**44.0**			44.0							
1.7.1.3	Installation	10/18/04	11/19/04		**0.0**										
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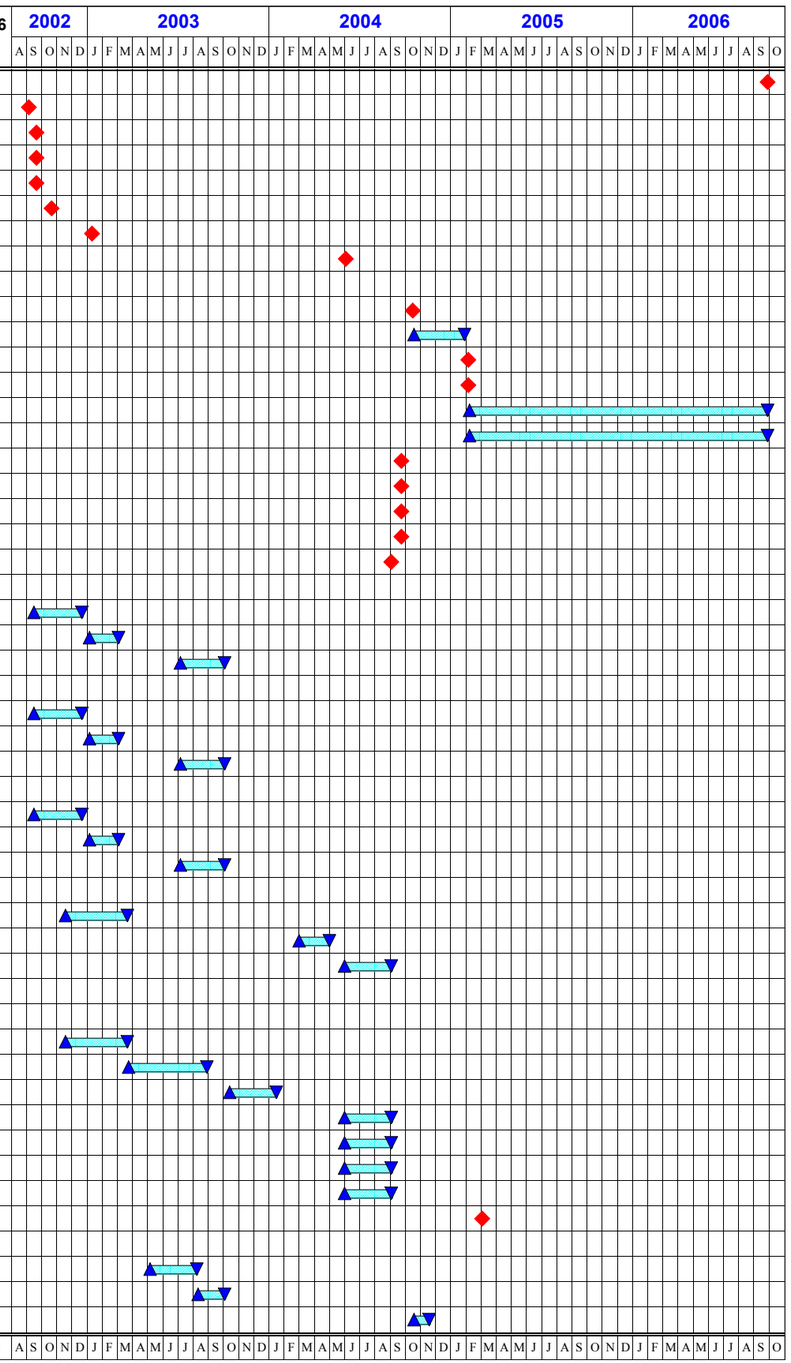
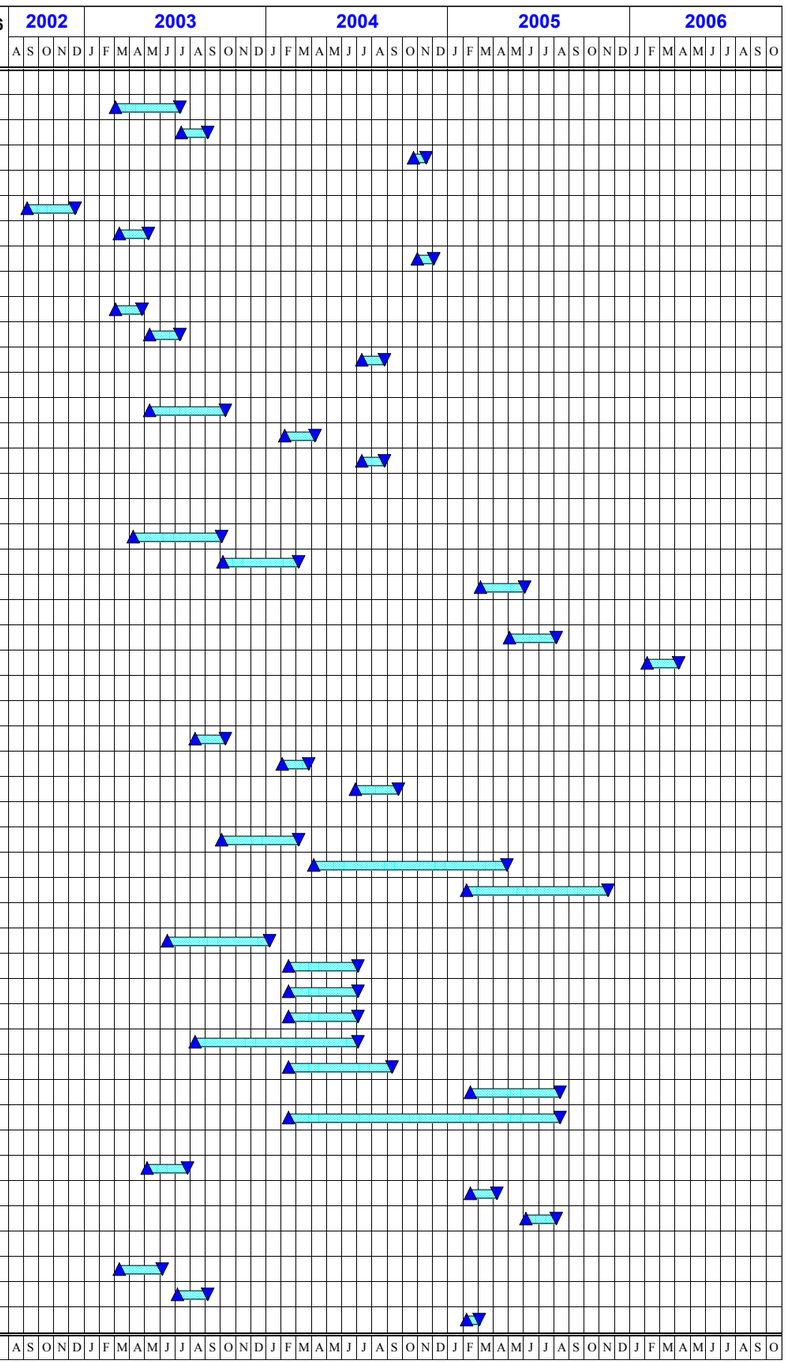


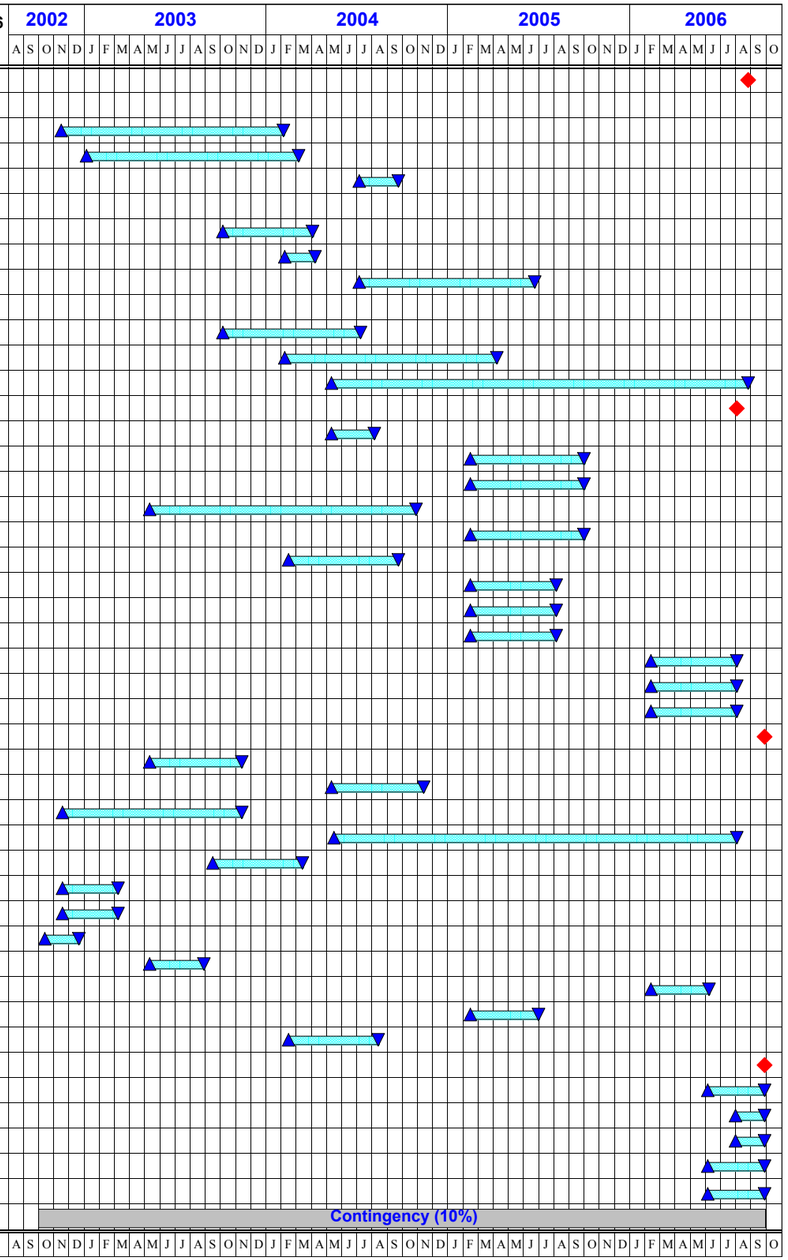
IXS WBS and Schedule

WBS	Activity Name	Start Date	Finish Date	Responsibility	BUDGET K$	DOE 02 K$	NSF 02 K$	DOE 03 K$	NSF 03 K$	MF 03 K$	DOE 04 K$	NSF 04 K$	MF 04 K$	DOE 05 K$	DOE 06 K$
1.7.2	Focusing Lens														
1.7.2.1	Design	3/3/03	7/11/03		**0.0**										
1.7.2.2	Procurement	7/14/03	9/5/03		**44.0**					44.0					
1.7.2.3	Installation	10/25/04	11/19/04		**0.0**										
1.7.3	Primary Monochromator														
1.7.3.1	Design	9/9/02	12/13/02		**0.0**										
1.7.3.2	Procurement	3/10/03	5/9/03		**400.0**			400.0							
1.7.3.3	Installation	11/1/04	12/3/04		**0.0**										
1.7.4	Integral Shutter														
1.7.4.1	Design	3/3/03	4/25/03		**0.0**										
1.7.4.2	Procurement	5/12/03	7/11/03		**50.0**				50.0						
1.7.4.3	Installation	7/12/04	8/27/04		**0.0**										
1.7.5	Monochromatic Shutter														
1.7.5.1	Design	5/12/03	10/10/03		**0.0**										
1.7.5.2	Procurement	2/9/04	4/9/04		**50.0**						50.0				
1.7.5.3	Installation	7/12/04	8/27/04		**0.0**										
1.7.6	Monochromatic Mirrors														
1.7.6.1	MERIX Mirror														
1.7.6.1.1	Design	4/7/03	10/3/03		**0.0**										
1.7.6.1.2	Procurement	10/6/03	3/5/04		**275.0**			175.0		30.0	70.0				
1.7.6.1.3	Installation	3/7/05	6/3/05		**0.0**										
1.7.6.2	HERIX Mirror														
1.7.6.2.1	Design	5/2/05	8/5/05		**0.0**										
1.7.6.2.2	Procurement	2/6/06	4/7/06		**300.0**										300.0
1.7.6.2.3	Installation	4/9/07	8/31/07		**0.0**										
1.7.7	Support Tables														
1.7.7.1	Design	8/11/03	10/10/03		**0.0**										
1.7.7.2	Procurement	2/2/04	3/26/04		**50.0**						50.0				
1.7.7.3	Installtion	6/28/04	9/24/04		**0.0**										
1.7.8	Optical Tables														
1.7.8.1	Design	10/3/03	3/5/04		**0.0**										
1.7.8.2	Procurement	4/5/04	4/29/05		**180.0**						90.0			90.0	
1.7.8.3	Installation	2/7/05	11/18/05		**0.0**										
1.7.9	Vacuum Hardware														
1.7.9.1	Ion pumps & controllers	6/16/03	1/9/04		**45.0**					45.0					
1.7.9.2	Ion gauges & controllers	2/16/04	7/2/04		**10.0**						10.0				
1.7.9.3	Inline valves	2/16/04	7/2/04		**10.0**						10.0				
1.7.9.4	Roughing valves	2/16/04	7/2/04		**5.0**						5.0				
1.7.9.5	Bellows	8/11/03	7/2/04		**10.0**					5.0	5.0				
1.7.9.6	Shielded spool transports	2/16/04	9/10/04		**10.0**						10.0				
1.7.9.7	Pumping station	2/14/05	8/12/05		**20.0**									20.0	
1.7.9.8	Miscellanous vacuum hardware	2/16/04	8/12/05		**15.0**						10.0			5.0	
1.7.9.9	Beamline rough vacuum system														
1.7.9.9.1	Design	5/5/03	7/25/03		**0.0**										
1.7.9.9.2	Procurement	2/14/05	4/8/05		**25.0**									25.0	
1.7.9.9.3	Installation	6/6/05	8/5/05		**0.0**										
1.7.10	Be Windows														
1.7.10.1	Design	3/10/03	6/6/03		**0.0**										
1.7.10.2	Procurement	7/7/03	9/5/03		**20.0**					20.0					
1.7.10.3	Installation	2/7/05	3/4/05		**0.0**										
					6186.0	1000.0	221.5	1003.0	337.5	284.0	1001.0	339.8	250.0	1006.0	743.2



IXS WBS and Schedule

WBS	Activity Name	Start Date	Finish Date	Responsibility	BUDGET K$	DOE 02 K$	NSF 02 K$	DOE 03 K$	NSF 03 K$	MF 03 K$	DOE 04 K$	NSF 04 K$	MF 04 K$	DOE 05 K$	DOE 06 K$
1.8	**General Instrumentation**		8/25/06	**M. Ramanathan**	**0.0**										
1.8.1	PSS														
1.8.1.1	Design	11/15/02	2/6/04		**0.0**										
1.8.1.2	Procurement	1/6/03	3/5/04		**110.0**						110.0				
1.8.1.3	Installation	7/5/04	9/24/04		**0.0**										
1.8.2	EPS														
1.8.2.1	Design	10/6/03	4/2/04		**0.0**										
1.8.2.2	Procurement	2/9/04	4/9/04		**33.0**						33.0				
1.8.2.3	Installation	7/5/04	6/24/05		**0.0**										
1.8.3	Controls														
1.8.3.1	Design	10/6/03	7/9/04		**0.0**										
1.8.3.2	Procurement	2/9/04	4/8/05		**320.0**						100.0			220.0	
1.8.3.3	Installation	5/10/04	8/25/06		**0.0**										
1.9	**MERIX Instrumentation**		8/4/06	**C. Burns**	**0.0**										
1.9.1	Spectrometer	5/10/04	8/6/04		**495.0**						80.0			415.0	
1.9.2	Optical table	2/14/05	9/30/05		**66.0**									66.0	
1.9.3	Detectors	2/14/05	9/30/05		**22.0**									22.0	
1.9.4	Monochromator	5/12/03	10/29/04		**220.0**			20.0			100.0		100.0		
1.9.5	Analysers	2/14/05	9/30/05		**33.0**									33.0	
1.9.6	Monochromator crystals	2/16/04	9/24/04		**33.0**						33.0				
1.9.7	Sample cell & translation	2/14/05	8/5/05		**11.0**									11.0	
1.9.8	Beam transport	2/14/05	8/5/05		**22.0**									22.0	
1.9.9	Riso slits	2/14/05	8/5/05		**22.0**									22.0	
1.9.10	Displex cryostat	2/13/06	8/4/06		**33.0**										33.0
1.9.11	Turbo pump	2/13/06	8/4/06		**16.5**										16.5
1.9.12	Small pumps	2/13/06	8/4/06		**2.2**										2.2
1.10	**HERIX Instrumentation**		9/29/06	**H. Sinn**	**0.0**										
1.10.1	Main Structure of Spectrometer	5/12/03	11/14/03		**77.0**				77.0						
1.10.2	CZT detector	5/10/04	11/12/04		**193.6**							193.6			
1.10.3	Monochromator	11/18/02	11/14/03		**300.0**		150.0		150.0						
1.10.4	Analyzers	5/17/04	8/4/06		**387.2**							137.2	150.0		100.0
1.10.5	Vacuum chamber	9/15/03	3/12/04		**44.0**				44.0						
1.10.6	Sample motion goniometers	11/18/02	3/7/03		**44.0**		44.0								
1.10.7	Sample slit motion delector	11/18/02	3/7/03		**16.5**		16.5								
1.10.8	Keithley multimeter	10/14/02	12/20/02		**11.0**		11.0								
1.10.9	Motor cables	5/12/03	8/29/03		**16.5**				16.5						
1.10.10	Vacuum pumps	2/13/06	6/9/06		**33.0**										33.0
1.10.11	Sample table	2/14/05	7/1/05		**55.0**									55.0	
1.10.12	VME crate for analyzer motors	2/16/04	8/13/04		**9.0**							9.0			
1.11	**Lab Office Module (LOM)**		9/29/06		**0.0**										
1.11.1	Office build out	6/5/06	9/29/06		**77.0**										77.0
1.11.2	Office furniture	8/1/06	9/29/06		**33.0**										33.0
1.11.3	Office equipment	8/1/06	9/29/06		**33.0**										33.0
1.11.4	Wet lab	6/5/06	9/29/06		**60.5**										60.5
1.11.5	Dry lab	6/5/06	9/29/06		**55.0**										55.0
1.12	**Contingency (10%)**	10/1/02	9/29/06		**0.0**										
					6186.0	1000.0	221.5	1003.0	337.5	284.0	1001.0	339.8	250.0	1006.0	743.2



Appendix B Letters of Funding Commitments